GRIM 3 Procedures

I. Instrument Name:

A. GRIM 3 Glass Refractive Index Measurement System (using a Leica Phase Contrast Microscope and a Mettler Toledo FP82HT Hot Stage)

II. Suggested Uses: Determining the Refractive Indices of Glass Particles and Other Similar Materials

III. Operating Procedures:

A. Calibrations
1. Calibration will be performed on a yearly basis. Calibration procedures can be found in the Trace Evidence Section Calibrations Manual.

B. Start-up and Analysis:
1. Powering Instrument
   a. Turn red switch on GRIM 3 main unit "ON" (this brings power to the GRIM 3)
   b. Turn black switch on side of Phase Microscope "ON" (this powers the light source)
   c. Turn computer on
   d. Allow the system to warm up and stabilize for one hour before taking any measurements
2. Open software and creating a case
   a. Double click on GRIM 3 icon labeled "Glass"
   b. Go to the menu bar and select
      i. "New Case" icon
      ii. Type in case reference in casebook folder "D:\SBI"
      iii. Click "OK"
      iv. Type in analyst's name (description of case is optional)
      v. Click "OK"
   c. Collapse Glass software and double click on Stage Manager icon
      i. Select Calibration in menu bar
      ii. Click on Select Oil-Wavelength
      iii. Select desired Oil and wavelength (normally B Oil, and 589nm)
      iv. Click Select
      v. Click Close
      vi. Exit Stage Manager program
3. Run Standard
   a. Return to Glass software
   b. Click Run Standard icon (yellow magnifying glass icon)
      i. Click New
      ii. Select appropriate standard, i.e. B4

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iii. Click OK
NOTE: if not using B oil, select Other above, and then fill in the appropriate standard in the item comment box on left column of the dialogue box

c. Prepare selected standard from the known glass standards provided
d. Place slide with glass particles, B oil, and cover slip in the Mettler Hot Stage
e. Click Measure GRIM (the Stage Manager screen appears)
f. Select up to four edges with sufficient contrast for analysis
g. Click on edge to place measuring box on glass fragment
   i. Click centre of box, and drag to reposition
   ii. Click just inside of box to resize
h. Select Search to determine approximate null temperature, and allow starting temperature to settle
NOTE: If starting temperature is too low click Go To, type in higher temperature, and then click OK
i. When Search is complete click Auto to measure null point and refractive index
NOTE: If a red blip appears on graph click on Cancel (number of edge box)
NOTE: Edge count is a measure of contrast. The edge count during analysis should optimally be between 50 and 99 (max).
j. After analysis is complete select Save Record (a box with the measurement information appears)
   i. If measurement is acceptable click OK
   ii. If measurement is unacceptable click on that fragment's row, and then check the Reject box
k. Repeat steps e-j for fragments 2-5
NOTE: Check phase rings frequently, and adjust as needed
l. Record RI value of standard in calibration log

4. Run control (known) glass sample
   a. Click Run Control icon (green magnifying glass icon)
   b. Click New in left column
   c. Type in reference for glass fragment, i.e. item number (the rest of the information bars are optional)
   d. Click OK
   e. Repeat steps #3, c-k for the control sample
5. Run recovered (unknown) glass sample
   a. Click Run Recovered icon (red magnifying glass icon)
   b. Fill in reference for glass fragment the same was as for the known glass sample
   c. Repeat steps #3, c-k for the recovered sample
6. Print
   a. Go to menu bar and select File
   b. Select Print

C. Shut-down
    1. Allow the system to cool
    2. Turn all instruments OFF in the reverse order of the ON procedure

IV. Safety Concerns
A. Glass slides are sharp and can cut you
B. High temperatures may be produced

V. Other Information
A. Consult Manufacturer's manuals as needed
B. When a calibration curve of match temperature versus RI is established for a series using the method of least squares, not all of the experimentally determined points will lie on the resulting smooth curve. As a result of experimental error, some points will lay slightly away form the line of the curve, either above or below it. Discrepancies between the "declared" and the "observed" RI will arise from a combination of random and systematic errors. By averaging the data from a large number of calibration curves, the contribution from random errors is reduced, and systematic errors will become more discernable.